

# H2Only

The Sediment Solution  
Design Review 2/9/2017

## **Team Members**

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## **Instructor**

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## **Client**

Scott Smith

## **Sponsor**

University of  
Idaho Facilities

# Problem Statement

The floor of the University of Idaho's chilled water tower accumulates sediment as the water lies stagnant. The current method of removing the sediment is very expensive.

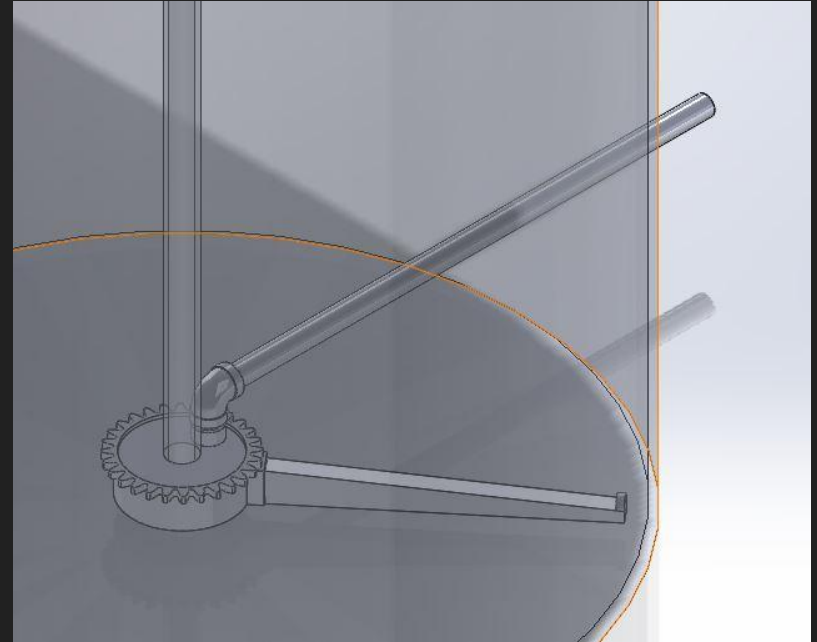


# Our Goal

An effective, efficient, less expensive system to clean tank

## How?

- Automatic operation
- Sediment level detection
- Permanently installed
- Inexpensive construction
- Separation of water and sediment
- Recirculation of clean water



# How it Works (The Basics)

## Suction

- Gravity head causes flow through system
- Pressure differential creates suction through device

## External Separation

- Centrifugal separator
- Recirculate clean water
- Dispose of sediment

# Full Scale Specifications

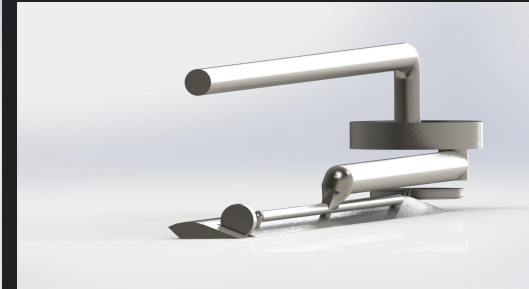
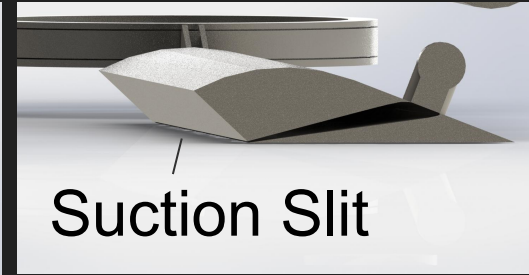
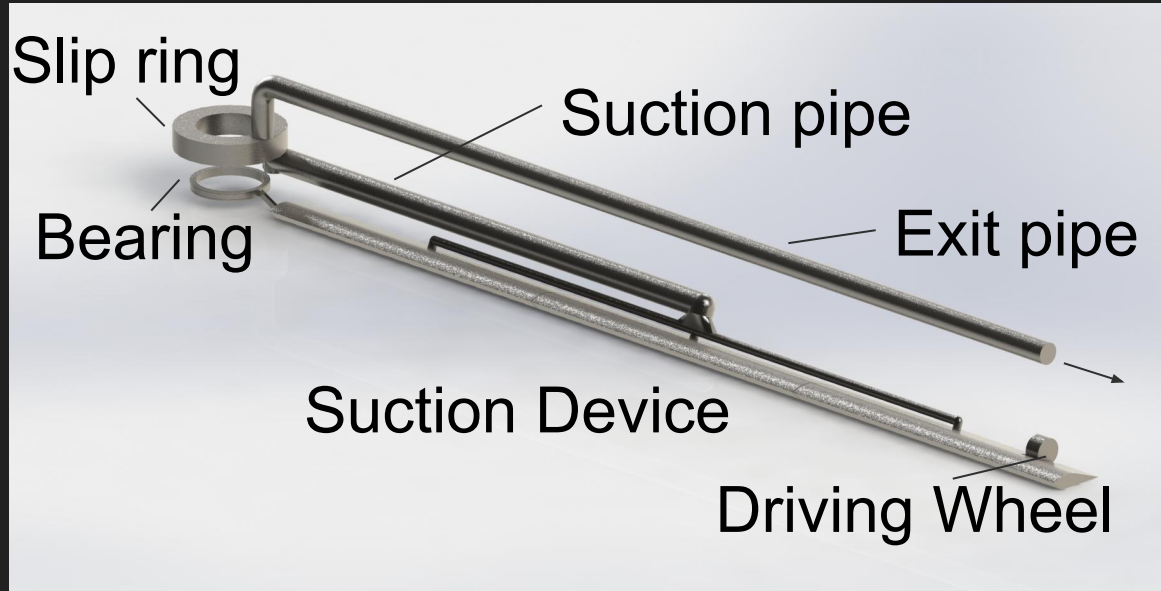
- Remove 95% of sediment each time system operates
- Continue tank operation while cleaning
- External sediment separation and recycle of clean water
- Low level of necessary maintenance
- Fully automated operation

# Prototype Specifications

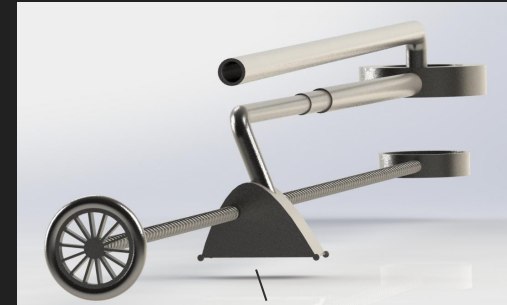
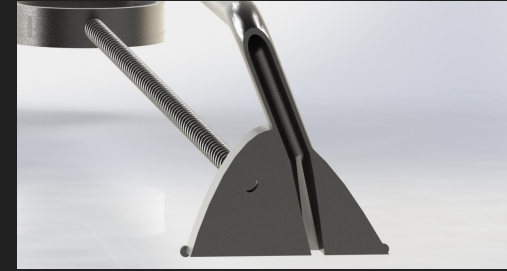
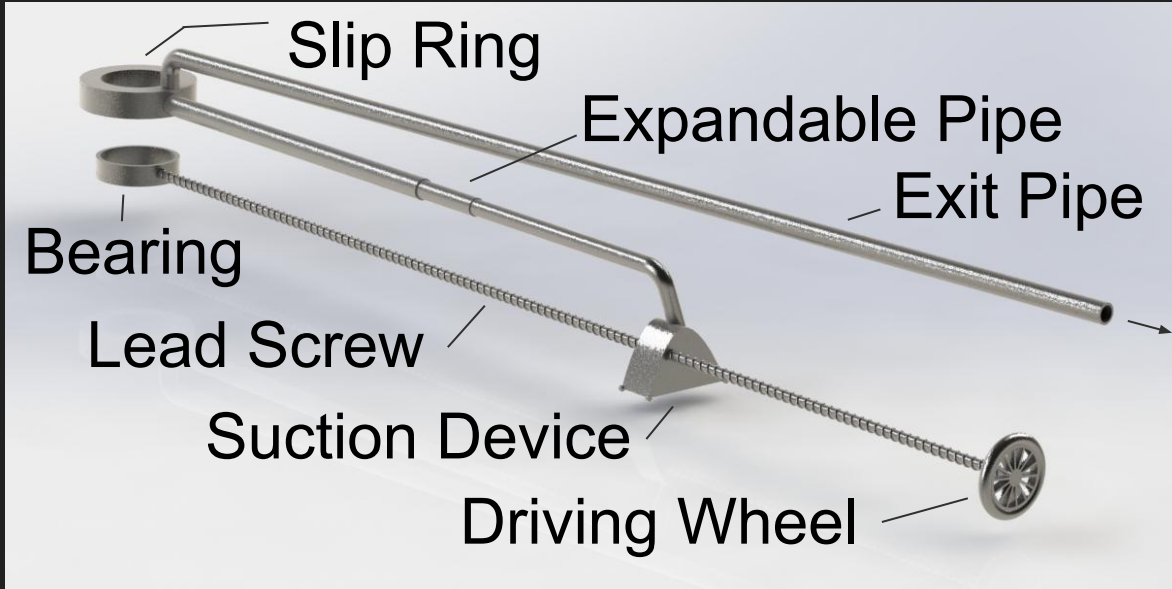
- Scalable to full scale dimensions
- Avoid resuspension
- Evenly distributed suction through slit
- Demonstrate proof of concept



# Sweeping Suction Design



# Lead Screw Design



Suction Slit



# Lead Screw Alternative

Yellow - Pulley

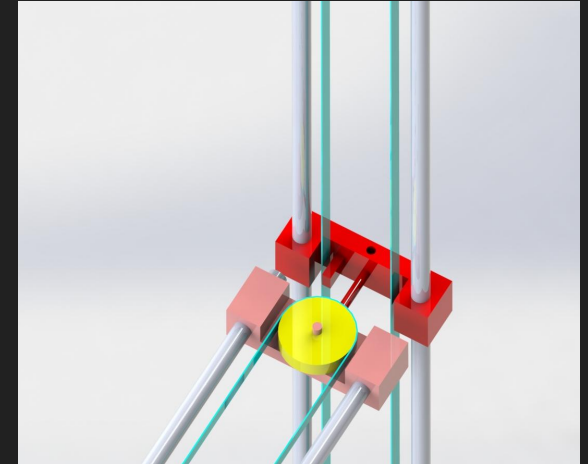
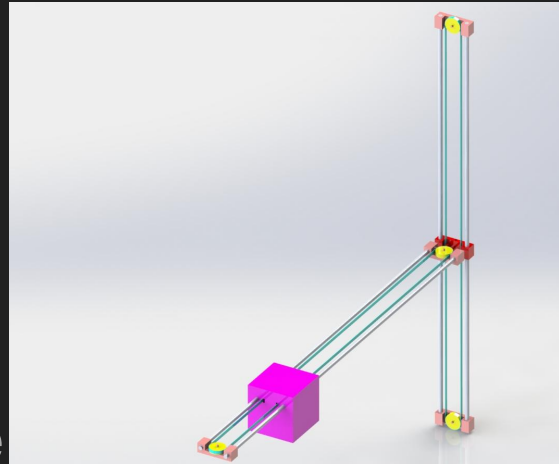
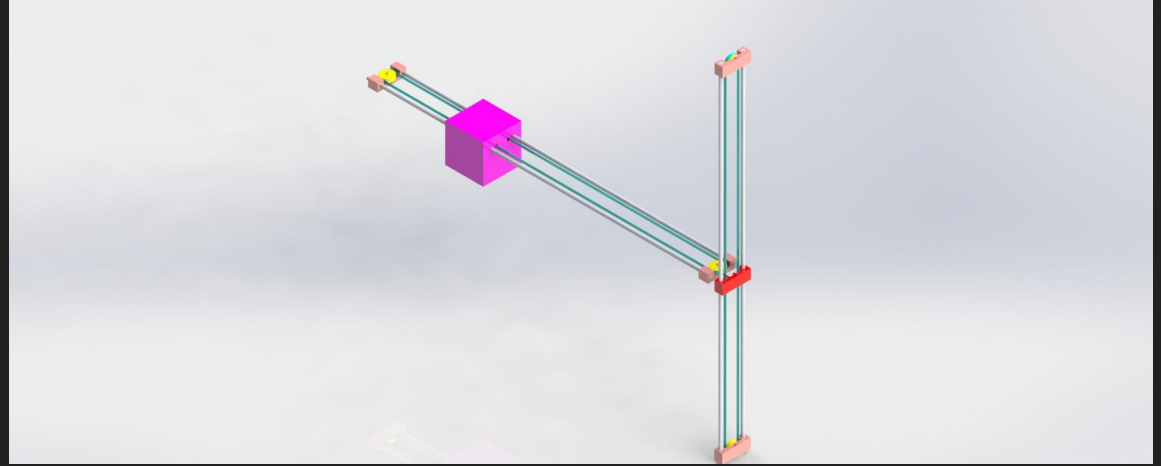
Grey - Guide Rod

Green- Belt

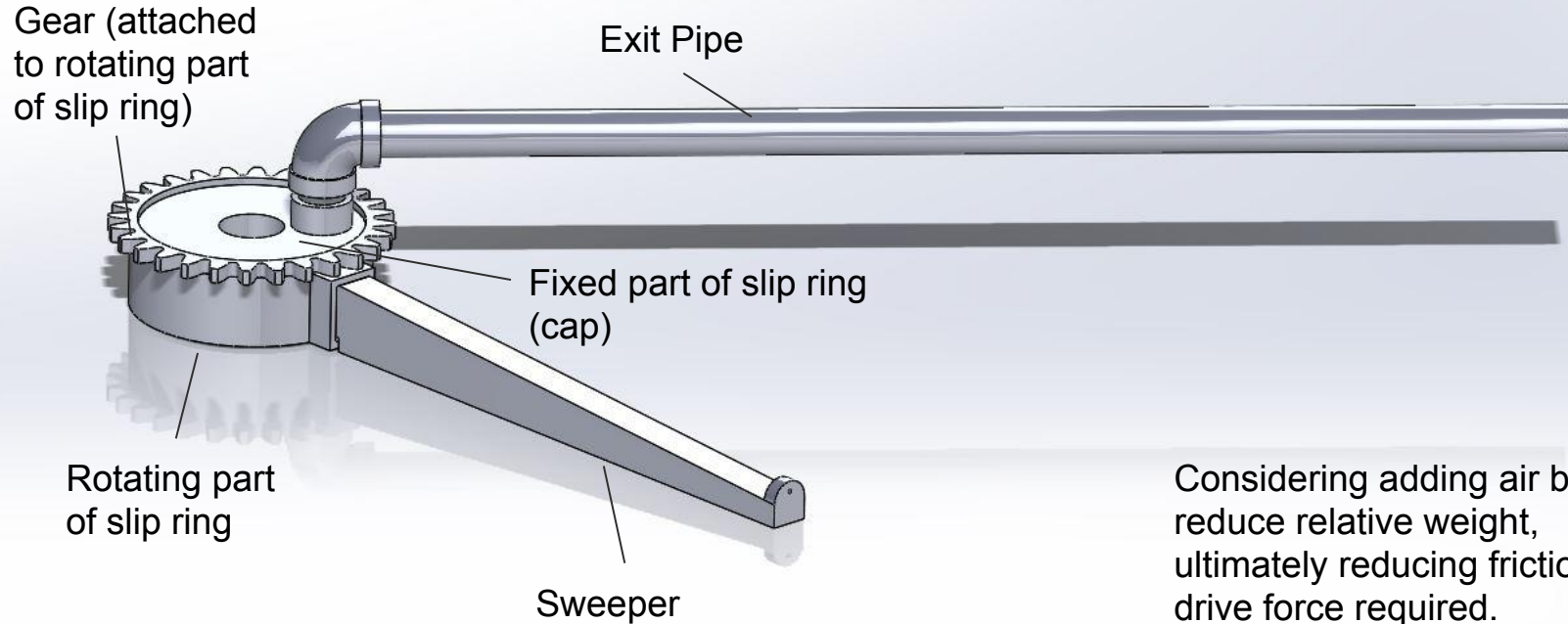
Pink - System Support

Red - Vertical Motion

Purple - Suction Device



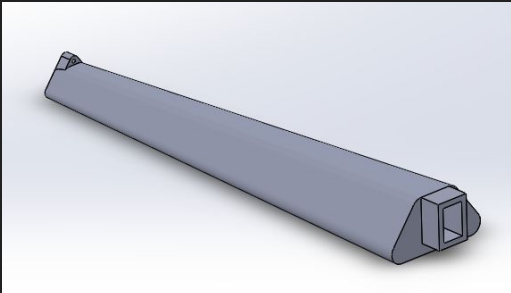
# Sweeping Suction Alternative



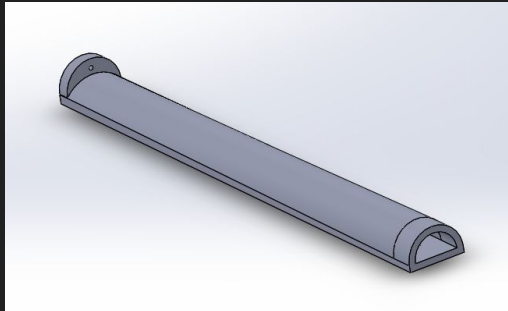
Considering adding air bags to reduce relative weight, ultimately reducing friction and drive force required.

# Sweeper Arm Profiles

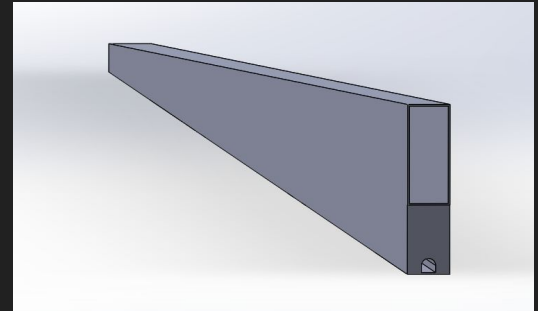
Design 1



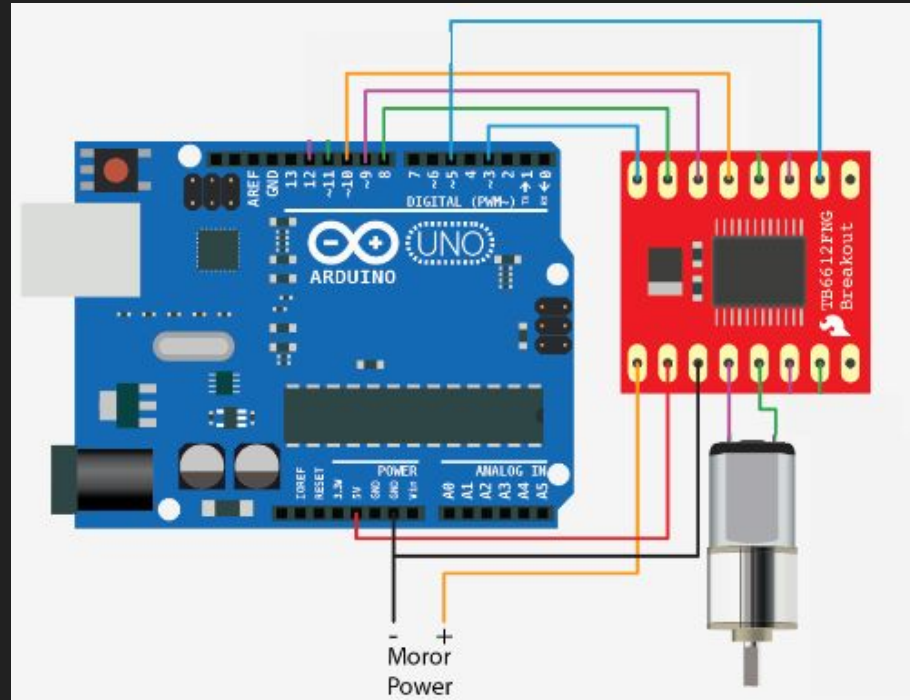
Design 2



Design 3



# Arduino Diagram

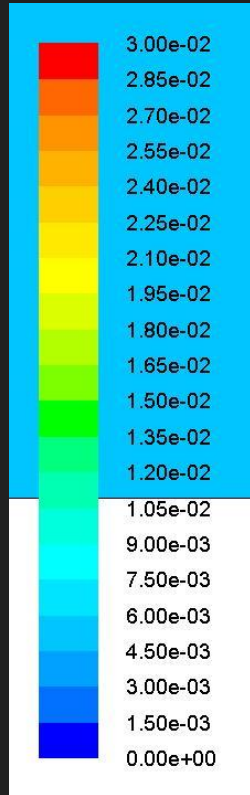


# Computer Modeling

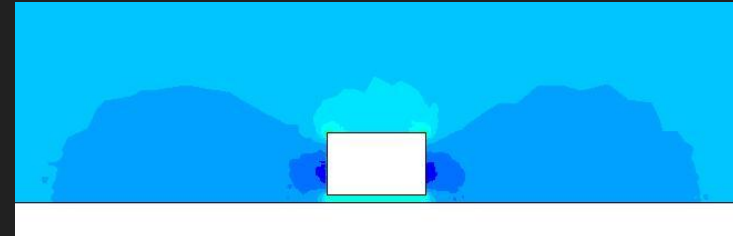
- EES was used to estimate
  - Volumetric Flow
  - Outlet and Inlet Velocity
  - Head Loss
  - System Curve
- CFD will be used for
  - Multifluid Suction Analysis
  - Fluid flow and displacement



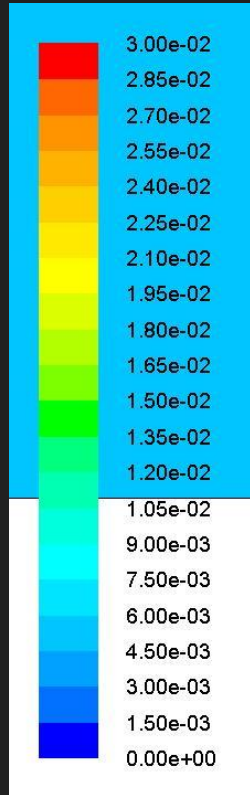
# CFD Analysis 12 Hour



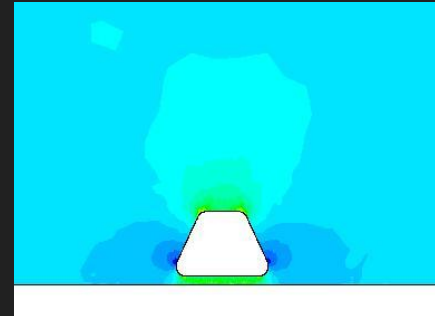
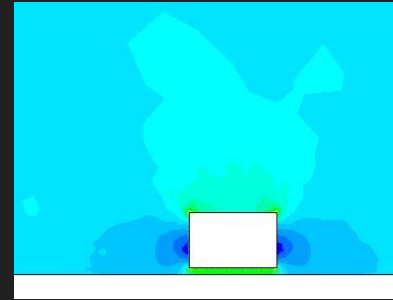
0.004654 ft/s  
Or  
0.00317 miles/h



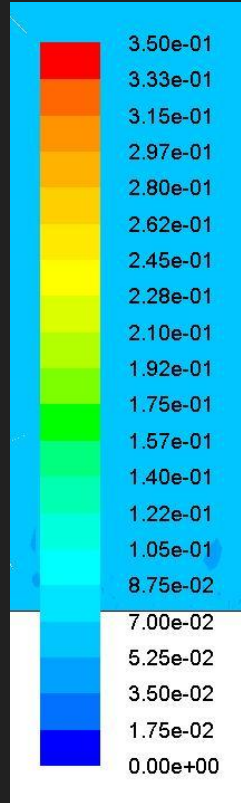
# CFD Analysis 8 Hour



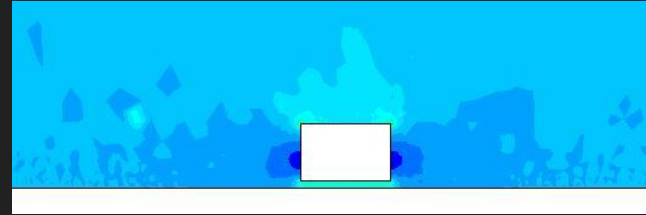
0.006981 ft/s  
Or  
0.004760 miles/h



# CFD Analysis 1 Hour



0.05565 ft/s  
Or  
0.03808 miles/hr





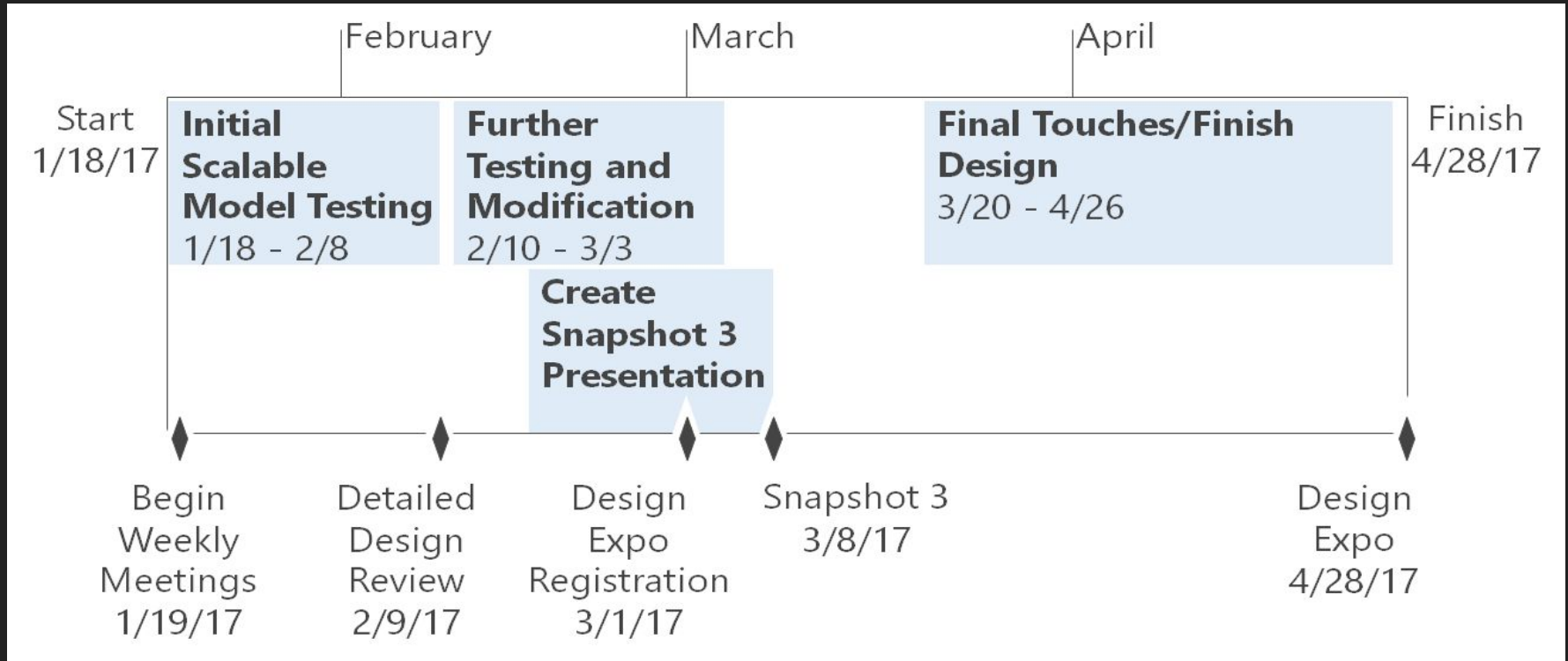
# Experimental Data

Tested flow rates with first prototype

Run	Head (ft)	Volume (gal)	Time (min)	Flow Rate (gpm)
1	7	2	1.39	1.44
2	7	2	1.37	1.46
3	7	2	1.35	1.49
4	7	2	1.35	1.48
5	7	2	1.37	1.46

Average Flow Rate = 1.466 gpm

# Schedule



A conceptual image featuring a lightbulb with a human face, wearing a dark suit and a striped tie. The lightbulb is positioned centrally, with its base visible. The background is dark and textured, filled with numerous question marks of various sizes and styles, some appearing as simple outlines and others as more complex, hand-drawn or sketched forms. The word "Questions?" is written in a large, white, sans-serif font across the middle of the image, partially overlapping the lightbulb's face.

Questions?